QD-M-004
REVISION E
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ORGANIZATIONAL INSTRUCTION

MAINTAINABILITY PREDICTION

OPR(s)	OPR DESIGNEE
QD10, QD20, QD30, QD40	Prince Kalia

DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline		11/19/97	
Revision	A	7/1/99	Changes made to reflect new organization code changes and/or Changes made to reflect new directives renumbering scheme
Revision	B	7/1/01	Changed OPR and OPR Designee. Revised Quality Records table.
Revision	C	9/04/02	Format and numbering change to implement requirements of QS-A-001 rev F.
Revision	D	05/12/04	Changed OPR and OPR Designee. Updated the document
Revision	E	10/15/04	Updated OI to implement HQ Rules Review in accordance with CAITS Action # 04-DA-01-0387) (Utilizing the word "Shall" for all requirements, removing ambiguity, removing non-requirements, etc.)

Maintainability Prediction

1. Purpose, Scope, Applicability

1.1 Purpose

The purpose of this OI is to provide an outline for performing maintainability predictions. Maintainability Predictions shall be used as a basis for estimating human resources requirements.

1.2 Scope

This OI describes the S&MA responsibility that shall be performed for flight hardware/software for Maintainability Prediction. Maintainability Prediction is the process of quantitatively estimating the maintainability of systems/subsystems and components during concept definition and design phases to compare design alternatives with respect to specified maintainability quantitative requirements for flight hardware and flight support equipment.

1.3 Applicability

This OI is applicable to all S&MA personnel supporting MSFC programs/projects with quantitative maintainability requirements.

2. Documents

2.1 Applicable Documents

MIL-HDBK-472 *Maintainability Prediction.*

MPD 8720.1 MSFC Reliability and Maintainability Program for Space Systems

2.2 Reference Documents

MIL-STD-470 *Maintainability Program For Systems and Equipment.*

MIL-HDBK-2165 Testability Handbook for Systems and Equipment

NASA-STD-8729.1 Planning, Developing and Managing an effective Reliability and Maintainability Program

MKIT Maintainability Tools Kit- Reliability Analysis Center

3. Definitions

Definitions applicable to this OI may be found in the Applicable and Referenced Documents shown in Section 2.

The following definitions specifically apply:

Maintainability — the ability of an item to be retained in or restored to an operable condition when the maintenance is performed under specified conditions.

Maintainability Predictions — estimates of performance capabilities under operational conditions. They serve as a means to measure design progress in achieving the desired goals or requirements pertaining to man-machine interfaces to assess human resource requirements.

4. Instructions

A considerable amount of information from a wide variety of sources is required to perform most maintainability predictions. Assumptions shall be clearly stated and identified. Reliability Analysis results shall be used as input for maintainability predictions especially under reliability centered maintenance concepts.

The steps below define the procedure for developing a maintainability prediction model and are referenced in the Flow Diagram Section 11. The analyst may also refer to MIL-STD-470 and MIL-HDBK-472 to perform the prediction. Typical inputs for reliability predictions include:

- Hardware functional description including specifications, schematics, functional flow diagrams
- Parts list
- Mission profile and environments
- Failure rate and sources
- Maintenance task data specific to Subsystem/Line Replaceable Unit (LRU) in terms of assessing time required to diagnose (detect and isolate) items failures, the time required to remove and replace the defective item and time required to return the system/subsystem to its original configuration and to perform the necessary checks.
- Maintenance model and block diagram or logic diagram.

The maintainability prediction shall be updated as appropriate (i.e., with design changes or design evolution). The steps below define the procedure for developing a maintainability prediction and are referenced in the Flow Diagram in Section 11. These predictions shall be validated through maintainability demonstration.

Steps	Action
4.1	Define the system for which the maintainability prediction is applicable.
4.2	Define the purpose and intended use (life cycle) for which system maintainability will be modeled and predicted.
4.3	Develop system maintainability block diagrams or other models (i.e., fault tree).
4.4	Identify applicable data sources.
4.5	Define the maintainability models.
4.6	Compute the maintenance parameters.
4.7	Forward results for evaluation.

5. Notes

The Safety and Mission Assurance (S&MA) Directorate shall coordinate the selection and tailoring of the prediction processes in this OI with the applicable program office and engineering organization.

5.1 Records

Record	Repository	Period of Time
Maintainability Predictions Report	As specified by the project plan.	As specified by the project plan.

6. Safety Precautions and Warning Notes

None.

7. Appendices, Data, Reports, and Forms

None.

8. Records

None

9. Tools, Equipment, And Materials

The user defined or program specified tools and processes may be used to meet systems requirement. Program specified tools shall have preference over user defined tools, materials and processes.

10. Personnel Training And Certification

R&M training shall include Maintainability Prediction training.

11. Flow Diagram

The following flow diagram represents the Maintainability Prediction process outlined in Section 4.